



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA

March 26, 2018

George ("Pat") Brooks
U.S. Department of the Navy
33000 Nixie Way, Bldg 50
San Diego, CA 92147

Dear Mr. Brooks:

Thank you for providing for review the *Draft Work Plan, Radiological Survey and Sampling*, Former Hunters Point Naval Shipyard, San Francisco, California ("Work Plan"), February 2018. The U.S. Environmental Protection Agency (EPA) reviewed this report in detail with a technical team including national experts in health physics, geology, and statistics.

The site has a history of radiological activity, and the radiological data evaluation process in 2017- 2018 found widespread signs of potential falsification and data quality concerns in all parcels where Tetra Tech EC Inc. conducted radiological work. Given these conditions, the actions proposed in the draft Work Plan would not be sufficient to demonstrate protection of human health and the environment to an extent that would allow for EPA approval of property transfer of affected parcels. More extensive sampling and analysis needs to be done to address potential exposure to workers and future residents due to the uncertainty regarding the potential extent of contamination. Attached are EPA comments that address the deficiencies in the draft Work Plan and propose additional measures to be taken to address data falsification and data quality concerns.

EPA understands that the Navy is also drafting Task Specific Plans for its work on specific parcels, and that the Navy will send the plan for Parcel G for review soon. In anticipation of this forthcoming draft, EPA is also submitting the attached recommendations in advance to inform the development of this draft. The previous data collected by Tetra Tech EC Inc. has significant uncertainty. Full excavation and scanning targeted at the survey units associated with the greatest potential for contamination will be crucial to address this uncertainty and demonstrate that the clean-up standards set in each Record of Decision have been met. As we wrote in December 2016, "EPA recommends using a health-risk based approach to prioritize areas of concern based on factors that should include, but not be limited to, historical records of activities, current or future exposure based on land uses, sampling results already collected, and combination of highest risk radionuclides."

20. Section 4.3.3 (Number of Samples in Survey Unit) does not provide sufficient justification to support a conclusion that collection of eighteen samples in the reference area and survey units is adequate to support a 99% statistical confidence in the outcome of the hypothesis testing used in the Wilcoxon Rank Sum (WRS) test. The number of samples needed depends in part on the variability of the data set. EPA analyzed the data provided by the Navy used in the past for determining reference background values. The maximum variability found in that data set would be associated with a requirement for more than eighteen samples per survey unit. However, if these data were collected by Tetra Tech EC Inc., they would be questionable. One option could be to collect new, reliable data to calculate the required number of samples, which may be higher or lower than eighteen, depending on the variability measured. Until reliable new results are collected, EPA recommends collecting 25 samples per survey unit based on the analysis detailed below:

The Work Plan uses MARSSIM equation 5-1 for determining the number of samples required for the WRS test. A value for variance (σ) of 0.28 for Ra-226 and of 0.033 for Cs-137 was selected in the Work Plan based on some portion of the total number of background data points. However, according to MARSSIM guidance, when the standard deviation of sample results in the reference area and the survey unit are different, the larger of these two values should be used to calculate the relative shift so the number of samples is sufficient to meet the assumptions of the statistical test. In this case, since site investigation sample data is not available, it seems appropriate to select a larger variance since it would be likely that site sample results will have a higher variability than background data. From review of the background reference area data sets provided by the Navy for Parcels A, B, C, D-1, and D-2, the largest variance (σ) for Cs-137 was identified as 0.0498 picoCuries per gram (pCi/g) from the off-site laboratory measurements from Parcel B. The largest variance reported for Ra-226 was identified as 0.479 pCi/g from the off-site laboratory data, also in Parcel B.

Using the remaining parameters selected in the Work Plan, which include confidence levels of 99% (i.e., alpha (α) and beta (β) error of 0.01), and a delta (Δ) of 1 for Ra-226 and 0.113 for Cs-137, the calculated number of samples (N/2) required to be collected considering the 20% increase in number of samples recommended by MARSSIM is 25 per on-site SU and per background reference area for Ra-226, and 21 per on-site SU and per background area for Cs-137:

See the example below for calculating N for Ra-226 using variance of 0.479:

From MARSSIM Table 5.1 Values of Pr for Given Values of the Relative Shift, Δ/σ , when the Contaminant is Present in Background

| Δ/σ | Pr | Δ/σ | Pr |
|-----------------|----------|-----------------|----------|
| 0.1 | 0.528182 | 1.4 | 0.838864 |
| 0.2 | 0.556223 | 1.5 | 0.855541 |
| 0.3 | 0.583985 | 1.6 | 0.871014 |
| 0.4 | 0.611335 | 1.7 | 0.885299 |
| 0.5 | 0.638143 | 1.8 | 0.898420 |
| 0.6 | 0.664290 | 1.9 | 0.910413 |
| 0.7 | 0.689665 | 2.0 | 0.921319 |
| 0.8 | 0.714167 | 2.3 | 0.944167 |
| 0.9 | 0.737710 | 2.5 | 0.961428 |
| 1.0 | 0.760217 | 2.8 | 0.974067 |
| 1.1 | 0.781627 | 3.0 | 0.983039 |
| 1.2 | 0.801892 | 3.5 | 0.993329 |
| 1.3 | 0.820987 | 4.0 | 0.997658 |

If $\Delta/\sigma > 4.0$, use $Pr = 1.00$

$$\frac{\Delta}{\sigma} = \frac{1}{0.479} = 2.0877 \approx 2.0$$

therefore $Pr = 0.921319$

FROM MARSSIM Table 5.2 Percentiles Represented by Selected Values of α and β

| α (or β) | $Z_{1-\alpha}$ (or $Z_{1-\beta}$) | α (or β) | $Z_{1-\alpha}$ (or $Z_{1-\beta}$) |
|------------------------|------------------------------------|------------------------|------------------------------------|
| 0.005 | 2.576 | 0.1 | 1.282 |
| 0.01 | 2.326 | 0.15 | 1.036 |
| 0.015 | 2.241 | 0.20 | 0.842 |
| 0.025 | 1.960 | 0.25 | 0.674 |
| 0.05 | 1.645 | 0.30 | 0.524 |

$$N = \frac{Z_{1-\alpha} + Z_{1-\beta}}{3(P_F - 0.5)^2}$$

$$N = \frac{(2.326 + 2.326)^2}{3(0.921319 - 0.5)^2} * 1.2 = 48.766 \approx 50 = N$$

$$\text{Therefore } \frac{N}{2} = 25$$

In addition, the following two considerations should be kept in mind during the site investigation process:

- a. It is possible that the variance for site investigative samples is higher than currently reported for background samples. For example, twenty Final Status Survey (FSS) systematic samples collected in Parcel G, Trench Unit 70 on December 3, 2007, indicate the highest variance associated with the Ra-226 results is 0.72 pCi/g. Using equations from Chapter 5 of MARSSIM and calculating the number of samples required to be collected using a variance of 0.72 at the 99% confidence level gives a value for 'N', (total number of samples) of 62.8. A 20% increase in samples (13 samples in this case) to account for lost samples, rejected data, etc., results in a total of 76. Dividing the 'N' value in half and rounding up to a whole number results in a value of 38, indicating 38 samples would be required to be collected in the reference area and 38 samples in each SU. As such, a re-calculation of the required number of samples needed to demonstrate the statistical confidence in the WRS test has been met will be required to be performed if site investigation sample data result in a variance greater than the 0.479 for Ra-226 or 0.0498 for Cs-137.
- b. The past practice at HPNS sitewide has been to excavate any material found that exceeds the cleanup goals, which are usually the reference background plus the Remedial Goal in the Records of Decision (RODs) for a given radionuclide, i.e., the "not to exceed" (NTE) approach. This approach is common practice at cleanup sites nationwide. In addition, EPA's national guidance² states the following: "EPA's Superfund remedial program general practice has been to use the NTE approach for soil where residential land use is assumed." Therefore, the final data set and reports generated by the Navy will need to demonstrate that all sample results are below the release criteria. If any of the data are above the release criteria, then either (1) sufficient data should be provided to determine that the elevated levels are due to Naturally Occurring Radioactive Material (NORM) or (2) exceedances must be remediated/removed.

Please revise Section 4.3.3 to address these concerns and to include a requirement to select 25 as the required sample size for the initial investigations of survey units and background

² EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-40, EPA 540-R-012-13, May 2014, Q3, p. 8.